Barriers to Innovation in Service SMEs: Evidence from Mexico

Journal:	*Industrial Management & Data Systems*
Manuscript ID	IMDS-08-2016-0339.R2
Manuscript Type:	Research Paper
Keywords:	Innovation, Services, Barriers to innovation, SMEs, Mexico

Responses to Reviewers

Dear Reviewer: 1

We are extremely thankful to the anonymous reviewer for having taken the time to review our paper for a second time and request further clarifications regarding some aspects of the statistical analyses we performed. This served as a further verification for us to be completely sure that our analyses are correct. With this, we are now 100% convinced that our methodology and analyses are correct and more clearly explained. Similarly as with our first revision, we have taken all your recommendations on board and made, where appropriate, the necessary modifications and improvements in the revised version of our paper. We have now taken special care to fully understand and act accordingly upon the concerns you raised. We sincerely hope that our clarifications to your queries/concerns and improvements made to our paper satisfy you requirements. Where applicable, we have used the track changes function to show the changes we made in the revised paper and hence they are highlighted in red colour in the text. We have also provided point wise answers to the raised queries below.

Please, notice that to clarify your concerns below we keep referring to the tables included in our article where the statistical analyses are presented. As per the manuscript guidelines of the Industrial Management & Data Systems journal, these tables are located at the bottom of the manuscript.

Query 1: How to solve the common method variance issues? This effects the reliability of the result of the study.

Response: As you suggested it during the first round of review, we incorporated in the first revision of our paper a Multitrait-Multimethod Model (MTMM) to analyse the variance of all of the items of the two scales (i.e. Barriers to Innovation and Innovation Activities), please, see Section 4, paragraphs 3 and 4 in red colour and Tables 4 and 5. Specifically, the MTMM analysis focuses on the extent to which data exhibit evidence of (Campbell and Fiske, 1959; Marsh 1988,1989, Schmitt and Stults 1986, Byrne and Bazana, 1996):

A) Convergent validity, the extent to which different assessment methods concur in the measurement of the same trait (i.e., construct) – ideally, these values should be moderately high;
B) Discriminant validity, the extent to which independent assessment methods diverge in their measurement of different traits – ideally, these values should demonstrate minimal convergence; and
C) Method effects, an extension of the discriminant validity issue. Method effects represent bias that can drive from use of the same method in the assessment of different traits: correlation among these traits are typically higher than those measured by different methods. [See Byrne, B.M. (2006). *Structural Equation Modeling with EQS: Basic concepts, applications, and programming. Second Edition*. Chapter 11: Application 9: Testing for Construct Validity: The Multitrait-Multimethod Model, pp. 325-351. London: LEA].

In the case of our research, the MTMM analysis established the existence of convergent validity and the invariance of the scales used to measure both the barriers to innovation and innovation activities. Similarly, the results of the MTMM analysis provided evidence of the existence of discriminant validity. Therefore, there are no variance issues in our study/methodology, please,

see Section 4, paragraphs 3 and 4 in red colour. This is corroborated by the results presented in Tables 4 and 5. We have tried to explain this in an even clearer way.

Query 2: The three independent variables are highly related, VIF will be required to examine the collinear issue.

Response: Yes, we fully agree with the learned reviewer in relation to the fact that the three independent variables are highly correlated. This is because they measure the same factor (i.e. barriers to innovation). However, as shown by the discriminant validity test presented in Table 2, there is no multicollinearity among the three independent variables. When performing an analysis of data using Structural Equation Modelling the EQS software does not provide the VIF (Variance Inflation Factor), which allows us to verify the absence of multicollinearity. Generally, the VIF is provided when carrying out a Linear Regression analysis, but in Structural Equation Modelling the absence of multicollinearity is verified through the Discriminant Validity test. In our paper this is provided in Table 2 by means of two Tests: the Confidence Interval Test proposed by Anderson and Gerbing (1988), which is below the diagonal, and indicates that, since there is no unit (1.0) between the lower range and the upper range, there is discriminant validity, and as a consequence, there is an absence of multicollinearity. This is because the factors, or dimensions, are measuring different things, but in turn all of them are measuring the same construct (i.e. Barriers to Innovation). For all this, VIF is not required in our analysis as kindly suggested by the learned reviewer. We sincerely hope you agree with this.

Query 3: In the methodology section, the authors still did not delineate the measurement of the three independent variables. The measurements of independent variables are critical to the results of the study.

Response: Table 1 shows the three independent variables (i.e. financial resources barriers, external environmental barriers and human resources barriers) and the specific 16 items (i.e. sub-barriers) that were defined and used to measure these three independent variables. Table 1 also presents the 7 items that were defined and used to measure the dependent variable (i.e. innovation activities). We used a 5-point Likert scale, with 1 = Not important to 5 = Very Important as limits. This is clearly discussed in Section 3, 2nd paragraph in red colour. In addition, the source of the data obtained is also explained. We consider that both Table 2 and the 2nd paragraph in Section 3 clearly show the delineation of the measurement of all variables. We sincerely hope the learned reviewer agrees with this.

Query 4: Also, how to confirm the validity of the three independent variables

Response: The validity of the three independent variables is presented through the construct validity, please see Table 1. In this table it can be verified that the Factorial Loads of the items of the independent variables are superior to 0.6 as suggested by Bagozzi and Yi (1988) and the Adjustment Indices have a value of between 0.80 and 0.89; And discriminant validity, please see Table 2, which is presented through two tests: the Confidence Interval Test (Anderson & Gerbing, 1988), and the Exponential Variance Test (Fornell & Larcker, 1981). All these tests have confirmed the validity of the three independent variables.

Query 5: Why these three independent variables were selected. The authors need justify it.

Response: The three independent variables (i.e. financial resources barriers, external environmental barriers and human resources barriers) were selected as these are the three dimensions in which it is possible to categorise the 16 items (i.e. sub-barriers, see Table 1) that

measure Barriers to Innovation. These barriers were defined by Madrid-Guijarro et al. (2009) through an Exploratory factor Analysis. We have now tried to explain this more clearly, please, see Section 3, 2nd paragraph in red colour.

Additional Questions:
Query 6: 1. Originality: Does the paper contain new and significant information adequate to justify publication?: Yes. But the methodlody section has serious flaw.

Response: Thank you very much to the learned reviewer for considering that our paper is original and contains new and significant information adequate to justify publication. We have responded to and address your concerns with our methodology as indicated in the five main queries above. We trust you will now be fully satisfied with our clarifications and actions taken.

Query 7: 2. Relationship to Literature: Does the paper demonstrate an adequate understanding of the relevant literature in the field and cite an appropriate range of literature sources? Is any significant work ignored?: The sigificance of this study may need to be further aritculated.

Response: the significance and contribution of our paper are discussed and established in the Introduction section, paragraphs 4 and 5 in red colour. We have tried to highlight these as per your suggestion. The significance and contribution of our paper mainly centre on the limited evidence of research on innovation barriers in service SMEs in Latin American countries. We also argue that "innovation research in service enterprises is currently of high relevance as the contribution of this type of organisations to national and international growth has increased considerably". Finally, we also argue that the significance of our study comes from the fact that the distinctive characteristics of innovation barriers can be understood within a particular context, i.e. Mexican region. Please, see Introduction section, paragraphs 4 and 5 in red colour.

Query 8: 3. Methodology: Is the paper's argument built on an appropriate base of theory, concepts, or other ideas? Has the research or equivalent intellectual work on which the paper is based been well designed? Are the methods employed appropriate?: This is the weakest part of the paper.

Response: As mentioned above, we have responded to and address your concerns with our methodology as indicated in the five main queries above.

Query 9: 4. Results: Are results presented clearly and analysed appropriately? Do the conclusions adequately tie together the other elements of the paper?: This section is well written.

Response: Many thanks to the learned reviewer for considering our results section well written (no action required)

Query 10: 5. Implications for research, practice and/or society Does the paper identify clearly between any implications for research, practice and/or society? Does the paper bridge the gap between theory and practice? How can the research be used in practice (economic and commercial impact), in teaching, to influence public policy, in research (contributing to the body of knowledge)? What is the impact upon society (influencing public attitudes, affecting quality of life)? Are these implications consistent with the findings and conclusions of the paper?: This section is well written.

Response: Many thanks to the learned reviewer for considering this section well written (no action required).

Query 11: 6. Quality of Communication: Does the paper clearly express its case, measured against the technical language of the field and the expected knowledge of the journal's readership? Has attention been paid to the clarity of expression and readability, such as sentence structure, jargon use, acronyms, etc.: The author(s) have not met the standards on revising the manuscript. Several major issues from previous version of manuscript were still not well articulated and strengthened. Above all, the major issues are critical and related to the methodology issue which needs to re-collect the data. Therefore, I suggest reject this manuscript.
Response: We trust that your concerns and comments have now been clarified and properly addressed as suggested above. We sincerely thank you for your constructive comments and guidance through the two revisions of our article. They have massively helped us to improve the quality standard of our paper.

Dear Reviewer: 2

We sincerely thank the reviewer for having revised our paper for a second time. Alongside the comments from Reviewer 1, these have massively helped us to improve different aspects of our article. In reference to the minor comments you made after your second review, we have taken them on board and, where applicable, we have improved the paper accordingly. We have used the track changes function to show the changes we made in the revised paper and hence they are highlighted in red colour in the text. We have also provided point wise answers to the raised queries below.

Additional Questions:
Query 1: 1. Originality: Does the paper contain new and significant information adequate to justify publication?: I believe that the originality of this research article will be of practical help to the local industry, and the only thing to add is to remind the reader that Mexico's role and status in the world are important.

Response: Thank you very much to the learned reviewer for the positive comment. We have now added that Mexico's economy is the second largest in Latin America, please, see Introduction section, 4th paragraph. This should help to put into context the importance of the role and status of Mexico in the world for the readers. We are unable to expand more in this issue due to the maximum words constraint set by the IMDS. We sincerely hope the reviewer agrees with this.

Query 2: 2. Relationship to Literature: Does the paper demonstrate an adequate understanding of the relevant literature in the field and cite an appropriate range of literature sources? Is any significant work ignored?: The authors clearly label many of Barriers' literatures, even if the theoretical basis is simple, and the study makes it very clear that this is something to be appreciated.

Response: Many thanks to the learned reviewer for the positive comment (no action required).

Query 3: 3. Methodology: Is the paper's argument built on an appropriate base of theory, concepts, or other ideas? Has the research or equivalent intellectual work on which the paper is based been well designed? Are the methods employed appropriate?: Structural

equation model processing technology is very good, can be used as an example of future research.

Response: Many thanks to the learned reviewer for the positive comment (no action required).

Query 4: 4. Results: Are results presented clearly and analysed appropriately? Do the conclusions adequately tie together the other elements of the paper?: All of the hypotheses are supported, and I think the clear structure of the study and the rich discussion are strengths that can confirm the author's research efforts.

Response: Many thanks to the learned reviewer for the positive comment (no action required).

Query 5: 5. Implications for research, practice and/or society Does the paper identify clearly between any implications for research, practice and/or society? Does the paper bridge the gap between theory and practice? How can the research be used in practice (economic and commercial impact), in teaching, to influence public policy, in research (contributing to the body of knowledge)? What is the impact upon society (influencing public attitudes, affecting quality of life)? Are these implications consistent with the findings and conclusions of the paper?: There is a deep discussion on Mexico's industrial innovation, hoping to create a better environment for innovation through this study and hopefully highlight the impact of Mexico's industrial innovation in the world, which should be a good contribution.

Response: Many thanks to the learned reviewer for the positive comment (no action required).

Query 6: 6. Quality of Communication: Does the paper clearly express its case, measured against the technical language of the field and the expected knowledge of the journal's readership? Has attention been paid to the clarity of expression and readability, such as sentence structure, jargon use, acronyms, etc.: This paper is a foundation for the regional research, and I hope that the author will discuss the changes in detail in the light of the relevant issues, which is helpful to the study of industry management.

Response: Many thanks to the learned reviewer for the suggestion. We will certainly consider these as part of the future research we will conduct in the subject and region.

Barriers to Innovation in Service SMEs: Evidence from Mexico

Abstract

Purpose – Specific research related to the study of innovation barriers in service SMEs in the Latin American region is limited. This study thus investigates the effects that external environmental, financial and human barriers have on innovation activities, particularly, within the context of Mexican service SMEs.

Design/methodology/approach – Three hypotheses were formulated and tested using structural equation modelling (SEM). Data were collected through an instrument that was developed based on relevant constructs adapted from the literature. The instrument was validated using Confirmatory Factor Analysis, Cronbach's alpha test and Composite Reliability Index to ensure the reliability of the theoretical model. The instrument was distributed among service SMEs in the Aguascalientes state of Mexico, from were 308 valid responses were obtained.

Findings – In general, the results indicate that all of the three barriers investigated (i.e. external environmental, financial and human) hinder innovation in service SMEs, with the external environmental barrier being the most significant of the three.

Practical implications – The findings of this research can inform managers of service SMEs and policy makers when formulating and implementing strategies to reduce innovation barriers.

Originality/value – Evidence suggests that specific research related to the study of innovation barriers in service SMEs in the Latin American region is limited. This paper fills this research gap by expanding the limited body of knowledge in this field and providing further evidence on this phenomenon. The study also enables the distinctive characteristics of innovation barriers to be understood within a particular context, expanding in this way the body of knowledge on this field.

Keywords: *Innovation, services, barriers to innovation, SMEs.*

1. Introduction

In the last decades, innovation has been considered in the literature of business and management sciences as one of the essential strategies that organisations can follow to achieve their objectives and goals (Fagerberg *et al*., 2004). An example of this is the poll conducted among 1,396 executives of the most important US multinational enterprises by the American Management Association (Jamrog, 2006). This poll showed that over 90% of the executives interviewed considered innovation activities as the most important element

for the growth and development of their firms in the long run. Similarly, 95% of them considered that innovation will be a fundamental strategy for the survival of enterprises in the near future (Jamrog, 2006). In this regard, the positive effects of innovation activities do not only benefit specific sectors or regions as such effects can also be perceived in all types of industries and countries (Fortuin & Omta, 2009).

However, despite the 'generic benefits' offered by innovation-based strategies and activities, evidence suggests that the focus of theoretical and empirical research on SMEs can be considered significantly more limited than that conducted in large enterprises (Rosli & Sidek, 2013; Börjesson *et al.*, 2014; Rheea *et al.*, 2010). This pervasive phenomenon has been prevalent despite the importance and strong influence that SMEs have not only on economic and social development (Xie *et al*., 2010) but also on the technological development of a variety of countries and enterprises (Zhu *et al*., 2006). In the case of innovation research in SMEs, different aspects of this activity have been recently investigated. For instance, Poorkavoos *et al.* (2016) explored the impact of inter-organisational knowledge transfer networks and organisations' internal capabilities on different types of innovation in SMEs in the high-tech sector. Purcarea *et al.* (2013) looked at SMEs' approach to learning and innovation. Diaz-Chao *et al.* (2015) analysed new co-innovative sources of labour productivity (i.e., ICT use, human capital and training, and new forms of work organisation) in small firms that produce for local markets. Gao & Hasfi (2015) examined the effect of SME business owners' characteristics on their firms' research and development spending in a transition economy. Furthermore, Gu *et al.* (2016) investigated the effect of internal and external sources on innovation, whereas Battistella *et al.* (2015) proposed a methodology for the implementation of technology road mapping in SMEs. Similarly, Ruiz-Jimenez & Fuentes-Fuentes (2013) explored the effects of product and process innovation on the relationships between knowledge combination capability and organisational performance while Ren *et al.* (2015) investigated the effects of search scope along the supply chain on the innovation performance of SMEs in emerging markets. Other recent studies regarding innovation within the context of SMEs include the researches undertaken by Maldonado-Guzman *et al*. (2016), Bouncken & Kraus (2013), Sharma *et al.* (2016), Fernandez-Mesa *et al.* (2013), Eggers *et al.* (2013), Wang *et al.* (2010), among others.

It is not easy for innovation to take place in SMEs, especially because these organisations have a variety of barriers that stop or inhibit it (Xie *et al.*, 2010). As a result of this, a high percentage of SMEs around the world have encountered serious problems with the development and adoption of innovation in their services, processes or management systems (Zeng *et al.*, 2010; O'Regan *et al.*, 2006). Additionally, SMEs have more barriers to innovation in their resources and capabilities than large enterprises (Hewitt-Dundas, 2006). This makes the process of innovation significantly more difficult for them (Hussinger, 2010).

Regarding research on innovation barriers, this is evident in both large organisations and SMEs in various industries and countries (e.g. Chesbrough, 2010; Madrid-Guijarro *et al.*, 2009; Hölzl & Janger, 2014; Antadze & Westley, 2012; D'Este *et al.*, 2012). However, specific research related to the study of innovation barriers in service SMEs in the Latin American region is limited, especially when compared to those conducted in the manufacturing industry (e.g. Minguela-Rata *et al.*, 2014; Madrid-Guijarro *et al.*, 2009;

Fisk, 2008; Oke, 2004; 2002a; 2002b; Griffin, 1997), Europe (e.g. Hölzl & Janger, 2014; Minguela-Rata *et al.*, 2014; Madrid-Guijarro *et al.*, 2009; Segarra-Blasco *et al.*, 2008; Galia and Legros, 2004; Hadjimanolis, 1999), Asia (e.g. Zhu *et al.*, 2012; Kim *et al.*, 1993), North America (e.g. Mohnen and Rosa, 2002) and Australia (e.g. Rogers, 2004; Atuahene-Gima, 1996). Thus, the main contribution of this paper lies in filling this research gap by expanding the limited body of knowledge in this field and providing further evidence on this phenomenon. This is done by analysing the effects that external environmental, financial and human barriers have on innovation activities, particularly, within the context of service SMEs located in the second larget economy in Latin America, i.e. Mexico (The Owrld Bank, 2016), and as suggested by Oke (2004), Larsen and Lewis (2007), Segarra-Blasco *et al.* (2008) and Xie *et al.* (2010). Innovation research in service enterprises is currently of high relevance as the contribution of this type of organisations to national and international growth has increased considerably (Oke, 2002a).

By focusing on Mexican service SMEs, the study also enables the distinctive characteristics of innovation barriers to be understood within a particular context. Mexico's economic, political and geographical characteristics as well as its current state as a fast developing country makes the study of innovation, including its barriers, different to all those previously studied. This justifies the opportunity of studying the innovation barriers of Mexican service SMEs in its own right, for the innovation theory to be able to understand its particular characteristics and in this way expand the body of knowledge of this field. Therefore, the significance of this study is that it fills a research gap regarding the lack of innovation studies in service SMEs in the Latin American region, provides further evidence of this phenomenon within the context of a highly relevant type of organisations (i.e. SMEs), and enables the understanding of particular characteristics of innovation barriers when studied within the setting of an specific region. The research, and its findings, is therefore relevant to both the theory and practice of innovation. In the case of the first, it expands the current body of knowledge of the innovation field, whereas in the case of the second, the findings derived from this research can inform managers of service SMEs and policy makers when formulating and implementing strategies to reduce innovation barriers.

The rest of the paper is organised as follows; the second section reviews the previous empirical researches on innovation barriers, from where the hypotheses tested in this study are formulated; the third section presents the methodology of the research, including the design of the data collection instrument and its validation and distribution; the fourth section analyses the obtained results, whereas these are discussed in section five. Finally, section six presents the conclusions, limitations of the research and future research agenda proposed from this work.

2. Literature Review and Formulation of Hypotheses

Although the concept of innovation has different connotations, it is usually associated to the development of completely new or significantly different products or services from those already existent in the market (Garcia & Calantone, 2002). In this line, innovation has been investigated in relation to the size of an organisation, with significantly more research dedicated to explore this activity within the context of large organisations (Rosli & Sidek, 2013; Börjesson *et al.*, 2014; Rheea *et al.*, 2010). However, in the particular case of research directed towards investigating different aspects of innovation in SMEs, authors

such as Zhu *et al.*, (2012), Madrid-Guijarro *et al.* (2009) and O'Regan *et al.* (2006) have emphasised the importance of exploring and understanding the potential barriers that may hamper the formulation of innovation strategies and/or development of innovation activities in SMEs. They suggest that by embodying this stream within innovation research in SMEs, better and more effective strategies to mitigate and overcome such barriers will be formulated.

Previous research has highlighted the innovation difficulties and barriers that SMEs have traditionally encountered. Consequently, it is possible to find in the literature a number of studies that show significant differences in the definition of these barriers. However, most of them are closely linked to costs, institutional restrictions and bureaucracy, human resources, flux of information, organisational culture and government policies (Baldwin & Lin, 2002; Mohnen & Röller, 2005) as well as limitations in resources and capacities (Hadjimanolis 1999; Hewitt-Dundas, 2006). For instance, Madrid-Guijarro *et al.* (2009) attributed some of the barriers to specific characteristics of SMEs such as limitations regarding external clients, existence of excessive control, lack of planning for changes demanded by the market and business environment, an inadequate education and lack of executives training. Hadjimanolis (1999) suggest that once inhibitors of innovation are identified, their effect is understood and action is taken to eliminate them, then the natural flow of innovation will be re-established. However, innovation demands motivation, extraordinary effort, and risk acceptance to proceed (Tidd et al., 1997; Hadjimanolis, 1999). It is a well-accepted fact that innovation is a risky and expensive endeavor, which results in low success rates (Cormican & O'Sullivan, 2004). Therefore, organisations need to assess the risk and minimise them. SMEs tend to face relatively more barriers to innovation than large firms due to inadequate internal resources and expertise hence SMEs need to obtain technology and resources from external sources through strategic networks (Rothwell, 1991).

In a similar trend, Hausman (2005) considered that strategic decisions of SMEs centred on the family members who own the enterprise restrict and block the adoption and implementation of innovation activities. Kim *et al.* (1993) concluded that heterogeneity in business environments and in the design and implementation of business strategies as well as the lack of training of the organisational structure are important barriers to innovation. Similarly, Hadjimanolis (1999) determined that barriers to innovation, in the context of small enterprises in developing countries, are related to higher levels of bureaucracy of government authorities and the lack of technical education of managers and employees of firms. Mohnen and Rosa (2002) reached a similar conclusion to Hadjimanolis (1999) in their research of SMEs in Canada. Baldwin and Lin (2002) also determined that barriers that stop innovation in SMEs are related to the lack of adoption of state-of-the-art technology and the bureaucracy of government authorities. March *et al.* (2002) established a similar conclusion when analysing the barriers to innovation in SMEs in Valencia, Spain.

Moreover, Smallbone *et al.* (2003) considered that low levels of return on investments and the lack of financing are the two main barriers that hinder innovation activities in SMEs. Rogers (2004) concluded that the main barriers to innovation in Australian SMEs are lack of training in management systems and the low level of investment and development. Galia and Legros (2004) considered that the main barriers to innovation in small French enterprises are linked to the level of financing. Finally, other common

innovation barriers are related to low level of investment in research and development, limited number of new products introduced in the market, lack of technological changes in products and production processes, and lack of prototype development (Madrid-Guijarro *et al.*, 2009; O'Regan *et al.*, 2006; Hewitt-Dundas, 2006; Mohnen & Röller, 2005).

As it can be perceived from the above discussion, a wide number of innovation barriers in SMEs have been identified. Therefore, to facilitate their study and understanding, authors such as Hadjimanolis (1999) and Madrid-Guijarro *et al.* (2009) have attempted their classification. In the case of Hadjimanolis (1999), he classified innovation barriers into internal and external. Where external barriers refer to supply, demand and environment related barriers whereas, internal barriers refer to resource related barriers such as lack of internal funds, technical expertise and management time, culture and systems related e.g. as out-of date accountancy systems and human nature related, such as attitude of top manager to risk and employee resistance to innovation. A more contemporary classification is that proposed by Madrid-Guijarro *et al.* (2009), who classified innovation barriers into three dimensions or factors, namely: financial resources barriers, external environmental barriers, and human resources barriers. This categorisation was adopted as the basis for this study.

Regarding financial barriers, the current literature considers costs as one of the most hindering barriers to the implementation of innovation in firms. As a result of this, the available financial resources that SMEs have will affect the innovation process (Freel, 2000). Therefore, if SMEs have the necessary financial resources then this barrier to innovation will decrease, consequently increasing the innovation capabilities of a firm (Frenkel, 2003; Hausman, 2005). Similarly, Souitaris (2001) considered that enterprises with higher levels of innovation achieve lower levels in innovation investment. Thus, costs and financial risks are essential factors in the innovation process of SMEs (Jensen & Meckling, 1976; Hall, 1990; Giudici & Paleari, 2000; Madrid-Guijarro *et al.*, 2009). Based on this evidence, the following hypothesis intends to investigate whether the availability of financial resources have a positive relationship with the level of innovation, particularly, within the context of Mexican service SMEs.

H1: The more financial resources are available, the higher the level of innovation in service SMEs

In relation to the external environmental barriers, Madrid-Guijarro *et al.* (2009) found that some of the confounding external barriers that have a strong and negative influence on innovation are: economic turbulence, lack of cooperation among enterprises, lack of information of markets and insufficient government support. On the other hand, Khan & Manopichetwattana (1989), Souitaris (2001), Katila & Shane (2005) and Frishammar & Hörte (2005) identified, in their respective investigations, a positive relationship between the external economic environment and the level of innovation. Similarly, the lack of information about the external environment can be a barrier difficult to dodge by SMEs so they are able to effectively implement an innovation process (Hadjimanolis, 1999; Frenkel, 2003; Galia & Legros, 2004). Considering the evidence presented, the following hypothesis intends to determine whether lowering the levels of external barriers enables a higher level of innovation in Mexican service SMEs.

H2: Lower levels of innovation external environmental barriers will enable a higher level of innovation in service SMEs

Finally, regarding human barriers, several investigations have considered that human resources can become a barrier to innovation in SMEs (Chen & Huang, 2009; Torrington, 1989; Gennard & Kelly, 1995; Kane, 1996; Grant & Oswick, 1998; Kane *et al.*, 1999). In order to eliminate this barrier, human resources professionals within organisations must take a more proactive role by minimising resistance to change and encouraging creative thinking (Collins, 1985; O'Neill, 1985; Dyer & Holder, 1988; Schuler, 1990; Miller, 1991; Moore & Jennings, 1993). Similarly, the lack of training in employees has an influence on innovation and the development of enterprises (Chen & Huang, 2009; Guest & Peccei, 1994; Fernie & Metcalf, 1995; Legge, 1995; Storey, 1995; Huselid, 1998). In this regard, several studies have emphasized the reluctance of managers and employees towards innovation (Kane *et al.,* 1999; Osterman, 2000; Zwick, 2002; McAdam & McConvery, 2004) as an important innovation barrier. Based on this evidence, the third hypothesis formulated below intends to investigate whether innovation capability in Mexican services SMEs can be increased by lowering human barriers.

H3: Lower level of deficiencies in human resources will increase innovation in service SMEs

3. Methodology

In order to test the three hypotheses formulated in this research, an empirical investigation was carried out in service SMEs operating in the state of Aguascalientes, Mexico. In this case, the business directory of the 'Sistema de Información Empresarial de México 2016 (Business Information System of Mexico) was employed as a reference framework for data collection. This business directory had registered 1,334 service enterprises between 5 and 250 employees by January 2016 in the state of Aguascalientes. A questionnaire survey was designed and distributed among all the directory members. As a result of the data collection process, 308 organisations responded to the questionnaire survey, hence resulting in a response rate of 23%. The final sample of 308 organisations had a reliability level of 95% and a maximum level of error of ±5%, with the sample selected by means of a simple random method. The questionnaires were administrated through personal interviews to each of the managers of the 308 service SMEs that participated in the study; the interviews took place between January and April, 2016. In general, the questionnaire collected information about the innovation activities in the previous two years as well as the barriers to innovation that the participant organisations had faced while undertaking innovation activities.

In order to measure innovation, managers were asked to indicate if their enterprises had implemented innovation processes in the previous two years (1 = Yes and 2= No). To measure the importance of innovation activities, they were also asked to evaluate *the service innovation*, *processes innovation and management systems innovation*, see Table 1, by means of a five-point Likert scale (from 1 = Not Important to 5 = Very Important) as their limits (Madrid-Guijarro *et al.*, 2009; Frishammar & Hörte, 2005; Kalantaridis & Pheby, 1999; Zahra & Covin, 1993). Regarding the barriers to innovation, sixteen 'sub-barriers' were selected, based on the Exploratory Factor Analysis as carried out and defined

by Madrid-Guijarro *et al.* (2009), and grouped into three barriers (i.e. i.e. financial resources barriers, external environmental barriers and human resources barriers), see Columns 1, 2 and 3 in Table 1. The barriers included *Financial Resources* (Column 1), which was studied based on five 'sub-barriers' (BRF1-BRF5) (Columns 2 and 3); *External Environment* (Column 1), which consisted of 6 'sub-barriers' (BAE1-BAE6) (Columns 2 and 3); and *Human Resources* (Column 1), which included five 'sub-barriers' (BRH-BRH5) (Columns 2 and 3). In this context, managers were asked to evaluate, by means of a five-point Likert scale (from 1 = Not Important to 5 = Very Important) as their limits, the importance of the sixteen 'sub-barriers' to innovation that were part of the three main barriers (i.e. financial resources barriers, external environmental barriers, and human resources barriers) used as the basis for this study.

Moreover, in order to evaluate the reliability and validity of the scales of barriers to innovation and innovation activities, a Factorial Confirmatory Analysis (FCA) was carried out by computing the method of maximum likelihood using the software EQS 6.1. (Brown, 2015; Bentler, 2005; Byrne, 2006). Similarly, the reliability of the scales was evaluated by means of Cronbach's alpha and the Composite Reliability Index (CRI) (Bagozzi and Yi, 1988). All the values of the scales exceeded the recommended level of 0.7 for both Cronbach's alpha and the CRI. This provided evidence of reliability and justified the internal reliability of the scales of the theoretical model (Nunnally & Bernstein, 1994; Hair *et al*., 1995). The adjustments used in the model were the *NFI*, *NNFI*, *CFI* and *RMSEA* (Bentler & Bonnet, 1980; Byrne, 1989; Bentler, 1990; Hair *et al.*, 1995; Chau, 1997; Heck, 1998).

The implementation of the FCA results is shown in Table 1. They indicated that the scales used had a good adjustment of data ($S\text{-}BX^2$ = 711.962; df = 224; p = 0.000; *NFI* = 0.854; *NNFI* = 0.881; *CFI* = 0.894; and *RMSEA* = 0.074). Furthermore, the FCA results suggested that all items of the factors related were significant ($p < 0.01$). Additionally, the size of all the standardized factorial loads was above the recommended value of 0.60 (Bagozzi & Yi, 1988). Finally, the Extracted Variance Index (EVI) of each pair of constructs of the theoretical model had a value above 0.5 as established by Fornell and Larcker (1981). This indicated that the theoretical framework used for this study had a good adjustment of data.

Insert Table 1 in here

Regarding the evidence of the discriminant validity, the measurement was provided by two tests; these are presented in Table 2. Firstly, with an interval of 95% of reliability, none of the individual latent elements of the matrix of correlation had a value of 1.0 (Anderson & Gerbing, 1988). Secondly, the extracted variance test (EVI) between each pair of constructs was higher than their corresponding EVI (Fornell & Larcker, 1981). Based on these criteria, it was concluded that the different measurements used in this research provided enough evidence of reliability as well as convergent and discriminant validity.

Insert Table 2 in here

4. Results

A structural equation model (SEM) was developed and used in order to test the three research hypotheses of the theoretical model of barriers to innovation by using the software EQS 6.1 (Brown, 2015; Bentler, 2005; Byrne, 2006). Similarly, the nomological validity of the theoretical model was analysed through the Chi-square test. It was mostly based on comparing the results obtained from the original model and the measurement model. In general, the Chi-square test suggested a non-significant statistical correlation between the constructs of the latent variable of the two models (Anderson & Gerbing, 1988; Hatcher, 1994). The results obtained by means of the SEM analysis can be seen in Table 3 and are illustrated in Figure 1.

Insert Table 3 in here

Insert Figure 1 in here

Regarding the first hypothesis $\mathbf{H_1}$, shown in Table 3, it can be clearly seen that the results obtained ($\beta = -0.204$ $p < 0.05$) indicated that financial resources had indeed a significant effect on the innovation activities of service SMEs. This suggests that the more financial resources service SMEs have available, the higher the innovation capacity that they are able to develop. As a result, $\mathbf{H_1}$ was accepted. In relation to the second hypothesis $\mathbf{H_2}$, the results obtained and presented in Table 3 ($\beta = -0.396$ $p < 0.01$) indicated that the external environment had also a significant effect on the innovation activities of service SMEs, indicating in this way that lower levels of innovation external environmental barriers will enable a higher level of innovation in service SMEs. As a consequence $\mathbf{H_2}$ was also accepted. Finally, regarding the third hypothesis $\mathbf{H_3}$, the results obtained ($\beta = -0.200$ $p < 0.05$) indicated that human resources had a significant impact on the innovation activities of service SMEs. This suggests that a lower level of deficiencies in human resources will increase innovation in service SMEs. For this reason, $\mathbf{H_3}$ was accepted. Overall, it can be concluded that all of the three studied factors of barriers to innovation have a significant effect on the innovation activities of service SMEs, with the external environmental barrier being the most significant of the three.

The goodness-of-fit results were examined through the Multitrait-Multimethod Model (MTMM) shown in Table 4. The MTMM provided evidence of the constructs validity (matrix level), showing that the fit related to all four MTMM models was similar.

Insert Table 4 in here

Using the Widaman (1985), Bagozzi and Yi (1990) and Cheung and Rensvold (2002) paradigms, Table 5 shows evidence of the convergence validity, which was analysed comparing the obtained results of the model in which adjustments were specified (Model 1) against those of the model where no adjustments were specified (Model 2). The difference in χ^2 between the two models ($\Delta\chi^2 = 280.19$, $p < 0.001$) established the existence of convergent validity and invariance of the scales used to measure both the barriers to innovation and innovation activities. In addition, Table 5 also shows the existence of discriminant validity between Model 1 and the model in which the factors were perfectly correlated (Model 3). This was due to the large difference in the value of χ^2 ($\Delta\chi^2 =$ **1,379.65, $p < 0.001$**). This provided evidence of the existence of discriminant validity. Similarly, the difference of χ^2 between Model 1 and the model in which the factors were not correlated (Model 4) ($\Delta\chi^2 =$ **110.38, $p < 0.001$**) also provided evidence of the existence of convergent validity. Therefore, it was possible to conclude that the evidence of convergent and discriminant validity for the four methods was strong to determine the invariance of the innovation barriers and innovation activities measurement scales.

Insert Table 5 in here

5. Discussion of Results

Based on the results obtained from this empirical research, it is possible to provide some conclusions on the three innovation barriers investigated. Firstly, the main barrier to innovation experienced by Mexican service SMEs operating in the state of Aguascalientes is that created by the external environment, see Table 3. External environmental barriers to innovation have been widely recognised in the academic literature not only as creating some of the most hindering factors to innovation but also as some of the most difficult to remove and overcome as these are normally out of the control of organisations (Madrid-Guijarro *et al.*, 2009; Martins & Terblanche, 2003; Hadjimanolis, 1999). Therefore, the results of of this study are in line with the findings obtained from the investigations of Madrid-Guijarro *et al.* (2009), Martins & Terblanche (2003) and Hadjimanolis (1999). External environmental factors acting as a barrier to innovation will vary from country to country, from industry to industry, and according to the size of the organisation (Madrid-Guijarro *et al.*, 2009; Hadjimanolis, 1999). Thus, it is important to identify these factors within specific contexts (i.e. specific countries and/or industries) so organisations can position themselves in a better situation to plan an effective strategy to meet their innovation objectives and minimise any errors that may impede the firm from achieving them. In the particular case of service SMEs in Mexico, the three different levels of government (i.e. federal, state, and municipal) existent in this country should work with these organisations to minimise specific external barriers such as complex bureaucracy,

lack of information from both the market and the existing technology, and lack of cooperation among SMEs with other firms of the same or a different sector as well as higher education institutions, public and private research centres. According to Guijarro *et al.* (2009), these particular external barriers can, until certain degree, be overcome with the support of local governments if properly understood. This calls for a closer collaboration between service SMEs and their local governments, and a better understanding of the external environmental barriers. In this line, this study has provided a basis for the external inhibitors to be better understood so the government can create effective collaboration strategies with service SMEs and appropriate policies for their elimination.

Secondly, it is possible to conclude that lack of financial resources is the second most important barrier to innovation in Mexican service SMEs, see Table 3. Therefore, managers of these companies consider that having financial resources available is of paramount importance for an organisation to be able to innovate. The perception of these Mexican managers of service SMEs is in line with the suggestions of Hausman (2005) and Frenkel (2003), who consider that the availability of financial resources is essential for increasing the innovation capabilities of a firm. This is because the cost of innovation activities is generally high (Greve, 2011). Therefore, the findings of this study are consistent with those previously obtained by Madrid-Guijarro *et al.* (2009), Hausman (2005), Bergemann (2005), Sivades & Dwyer (2000) and Frenkel (2003), who found a positive correlation between the availability of financial resources and the ability to innovate.

Thirdly, based on the results of this study, it is also possible to conclude that human resources can also act as a barrier to innovation. This is in line with a large number of investigations that have determined that under certain circumstances, managers and personnel can act as potential barriers that may hinder innovation initiatives (e.g. Chen & Huang, 2009; Torrington, 1989; Gennard & Kelly, 1995; Kane, 1996; Grant & Oswick, 1998; Kane *et al.*, 1999). However, the results of this study regard human resources as the barrier with the least effect on innovation activities in Mexican service SMEs. Consequently, resistance to change from both managers and employees, lack of trained and specialised personnel for the development of innovation activities, and the occasional training of workers and employees do not play a critical role, when compared with external environmental and financial barriers, in stopping organisations from being innovative. The results of this research are still consistent with those obtained by Freel (2000), Chiao (2002) and Garcia and Briz (2000), who concluded that resistance to change from employees and executives of SMEs can act as barriers to innovation in this type of organisations.

Within the context of the results obtained, it is possible to conclude, in general terms, that the growth of Mexican service SMEs will greatly depend on their ability to eliminate barriers to innovation, and on the integration of innovation activities as an essential business strategy that allows this type of organisations to develop innovation activities in services, processes and management systems. Therefore, service SMEs that act accordingly will have more possibilities to significantly increase their level of performance and competitiveness (de Brentani, 1989; Mohammed-Salleh & Easingwood, 1993; Griffin, 1997; Cefis & Marsili, 2006).

6. Concluding Remarks, Limitations and Future Research

This paper investigates the effects of external environmental, financial and human barriers on innovation in Mexican service SMEs. In general, the results signify the idyllic relationship between these barriers and innovation activities. Thus, this research contributes to the literature of business and management sciences and innovation theory by providing a further validation of the effects of these barriers on innovation, but in this case, within the specific context of Mexican service SMEs. In this way, the paper fills a research gap in the innovation literature by addressing the lack of studies of innovation barriers in service SMEs in the Latin American region, enabling in this way a refined understanding of the distinctive characteristics of innovation barriers within a particular context.

The results have several implications for both managers of service SMEs and the organisations themselves. For instance, by knowing which of the three studied barriers have the strongest influence on innovation, their effects are better understood so managers can design and implement effective control and management mechanisms to promote actions of change or improvement in the creation of new services, processes and management systems. For this, managers of service SMEs must get more involved in innovation activities as this will increase the internal and external innovation capability of organisations. It is for this reason that managers must develop new control mechanisms of innovation activities, and use different support programmes offered by business chambers and government offices to eliminate barriers to innovation. This will not only ensure the survival of organisations but also their future growth. Additionally, managers of service firms will have to find a way to eliminate employees' resistance to innovation and promote their creativity as innovation demands that all members of the organisation work together.

Similarly, the research offers some insight into the importance of developing strategies and managerial practices which could help service SMEs in overcoming these barriers. In addition, governments can benefit from the findings of this research as these can inform the design and implementation of policy interventions to support the elimination of innovation barriers, especially those posed by the external environment.

In terms of the research limitations, various constraint factors were encountered. These factors are important to be highlighted for their consideration in similar future studies. The first factor is related to the regional collection of data as only organisations from the Aguascalientes state of Mexico were considered as part of the study. Further research can include other states of Mexico, or even other countries of Latin America. This will allow regional factors to be taken into consideration and compared with those of other regions. A second limitation is that only qualitative variables were considered for the measurement of barriers to innovation and innovation activities. Further researches can consider the use of quantitative variables such as investment in research and development in order to verify if there are significant differences in the results obtained.

A third limitation is that the questionnaire was administrated to managers of service SMEs only. This created the assumption that they had significant knowledge regarding barriers to innovation and innovation activities. Thus, further investigations can also involve employees, clients and suppliers to validate and expand the results obtained. Finally, further research can go beyond the results obtained through this research to investigate how the findings of this study connect to other stages of the overall performance

of service SMEs. For instance, what would be the effects of the innovation barriers within the overall context of innovation value chain as suggested by Roper *et al.* (2008)? What other dimensions of organisational performance (e.g. sales, labour productivity, capacity growth, etc.) can be affected, and how, by external environmental, financial and human innovation barriers? These questions could be addressed in future research and are hence part of the future research agenda proposed by this paper.

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Tables

Table 1. Internal consistency and convergent validity of the theoretical model

Barriers	Sub-barriers	Sub-barriers coding	Factorial Loading	Robust t-Value	Cronbach's Alpha	CRI	EVI
Financial Resources Barriers	Excessive risk perceived with innovation	BRF1	0.701***	1.000[a]	0.861	0.863	0.561
	High costs of innovation	BRF2	0.765***	15.152			
	Costs of innovation difficult to control	BRF3	0.907***	18.200			
	Problems to obtain financing	BRF4	0.603***	12.077			
	Fear of being the first to innovate	BRF5	0.715***	13.266			
External Environmental Barriers	Economic turbulence	BAE1	0.697***	1.000[a]	0.878	0.879	0.548
	Lack of market information	BAE2	0.791***	10.215			
	Lack of cooperation between enterprises	BAE3	0.784***	8.817			
	Lack of infrastructure in the state	BAE4	0.696***	9.038			
	Insufficient government support	BAE5	0.785***	9.423			
	Lack of information about technologies	BAE6	0.680***	9.286			
Human Resources Barriers	Managers resistance to change	BRH1	0.710***	1.000[a]	0.890	0.891	0.621
	Employees resistance to change	BRH2	0.765***	19.600			
	Lack of qualified and specialized personnel	BRH3	0.824***	15.530			
	Poor staff training activity within the company	BRH4	0.849***	16.684			
	Trouble keeping qualified personnel in the company	BRH5	0.784***	14.905			
Innovation Activities	**Products/services**				0.896	0.898	0.558
	Changes or improvements in existing products / services	INN1	0.807***	1.000[a]			
	Marketing new products / services	INN2	0.730***	20.437			
	Processes						
	Cambios o mejoras en los procesos de producción/servicios	INN3	0.806***	25.446			
	Acquisition of new capital equipment	INN4	0.709***	18.709			
	Management systems						
	Direction and management	INN5	0.660***	15.574			
	Purchasing and supply	INN6	0.708***	17.675			
	Commercial / Sales	INN7	0.794***	22.978			

	$S\text{-}BX^2$ (df = 224) = 711.962; p < 0.000; NFI = 0.854; NNFI = 0.881; CFI = 0.894; RMSEA = 0.074

[a] = Constrained parameters to such value in the identification process.

*** = p < 0.01

Table 2. Discriminant validity of the measurement of the theoretical model

Variables	Financial Resources Barriers	External Environmental Barriers	Human Resources Barriers	Innovation Activities
Financial Resources Barriers	**0.561**	0.181	0.267	0.209
External Environmental Barriers	0.300 - 0.552	**0.548**	0.213	0.184
Human Resources Barriers	0.377 - 0.657	0.325 - 0.597	**0.621**	0.208
Innovation Activities	0.275 - 0.639	0.293 - 0.565	0.266 - 0.646	**0.558**

The diagonal represents the Extracted Variance Index (EVI), whereas above the diagonal the variance is presented (squared correlation). Below diagonal, the estimated correlation of factors is presented with 95% confidence interval.

Table 3. Results of the SEM of the barriers to innovation model

Hypothesis	Structural Relationship	Standardised Coefficient	Robust t-Value	Hypothesis Status after Test
H1: The more financial resources are available, the higher the level of innovation in service SMEs.	Financial R.B. → Innovation	-0.204**	2.178	Negative correlation **Accepted**
H2: Lower levels of innovation external environmental barriers will enable a higher level of innovation in service SMEs.	External E.B. → Innovation	-0.396***	4.171	Negative correlation **Accepted**
H3: Lower level of deficiencies in human resources will increase innovation in service SMEs.	Human R.B. → Innovation	-0.200**	2.149	Negative correlation **Accepted**
$S\text{-}BX^2$ (df = 224) = 711.962; p < 0.000; NFI = 0.854; NNFI = 0.881; CFI = 0.894; RMSEA = 0.074				

*** = P < 0.01; ** P < 0.05

Table 4: Summary of Goodness-of-Fit Indexes for MTMM Models

Model	χ^2	df	SRMR	CFI	RMSEA	90%	C.I.
1. Freely correlated traits[a]; freely correlated methods.	806.15	224	0.067	0.94	0.072	0.085	0.099
2. No traits; freely correlated methods.	1,086.34	226	0.096	0.88	0.110	0.105	0.118
3. Perfectly correlated traits; freely correlated methods.	2,185.80	230	0.127	0.86	0.116	0.116	0.127
4. Freely correlated traits[b]; freely correlated methods.	916.53	225	0.069	0.93	0.082	0.092	0.102

[a]Represents respecified model with an equality constraints imposed between E5 and E9.
[b]Represents respecified model with an equality constraints imposed between E5 and E7.

Table 5: Differential of Goodness-of-Fit Indexes for MTMM Nested Model Comparisons

Model Comparisons	Difference in		
	$\Delta\chi^2$	df	CFI
Test of Convergent Validity			
Model 1[a] vs. Model 2 (traits)	280.19	2	0.06
Test of Discriminant Validity			
Model 1[a] vs. Model 3 (traits)	1,379.65	6	0.80
Model 1[a] vs. Model 4[b] (methods)	110.38	1	0.01

[a]Represents respecified model with an equality constraints imposed between E5 and E9.
[b]Represents respecified model with an equality constraints imposed between E5 and E7.

Figures

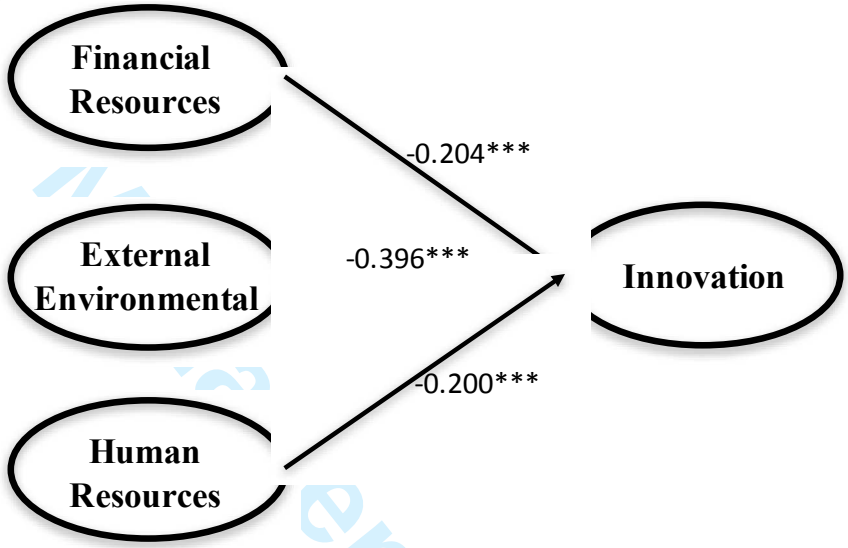

Figure 1. SEM model